

# Cooling Fan

Normal body temperature is generally around 37°C (98.6°F), but each person's actual temperature varies by age, activity, and time of day. The human body is very good at keeping its temperature within a safe range despite the temperature of the surrounding air. If you are too hot, you may begin to sweat, and as the sweat evaporates, it helps cool your body. Wind, or blowing air, makes it easier for the air to evaporate sweat from your skin. As a STEM extension to the “Hot Hands” experiment, you will use a Vernier Digital Control Unit (DCU) to turn on a small DC fan when the temperature reading from the Stainless Steel Temperature Probe exceeds a threshold value.

## OBJECTIVES

- Turn on a fan when the temperature of your hand is hot.
- Control a sensor-based system with the DCU.

## REFERENCE EXPERIMENTS

“Hot Hands” – Experiment 1 from Middle School Science with Vernier

“Are We Cool or What?” – Activity 1 from *Let's Go! Investigating Temperature*

## EQUIPMENT

Vernier interface with a digital port  
Logger *Pro*  
computer  
USB cable  
Stainless Steel Temperature Probe

Digital Control Unit (DCU)  
DCU Cable  
LabQuest or LabPro power supply  
5 VDC fan

## PRELIMINARY DATA ANALYSIS

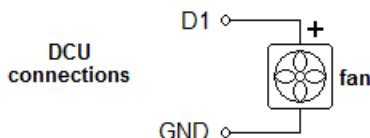
In the “Hot Hands” experiment, you calculated the average of your team's maximum hand temperatures. You will use that average as the threshold value for this extension.

## BACKGROUND

In this extension, you will be using the DCU as a digital switch to power the fan based on a threshold temperature value. The DCU is an electronic device that allows you to control up to six lines for on/off control of fans, LEDs, motors, or other DC electrical components. The DCU connects to any DIG port on a Vernier interface and is powered by either the LabQuest or LabPro DC power supply. A 9-pin cable with bare wires on one end is supplied for use in building projects. There are connections for the six digital lines, plus a power connection and two ground connections. The color code of the wires is identified on a label attached to the cable.

## EQUIPMENT SETUP

1. Plug the 9-pin cable into the socket on the side of the DCU.
2. Connect the fan to the D1 and GND leads on the DCU cable.



**Tip:** DC fans often have polarity. Connect the positive lead (red wire) to D1 and the negative lead (black wire) to GND. You can connect to either one of the two GND lines.

3. Connect a power supply to the DCU.
4. Connect the DCU to the first DIG port on the interface.
5. Plug the Stainless Steel Temperature Probe into any analog channel on the interface.
6. Connect the interface to the computer.

## SOFTWARE SETUP

1. Start Logger Pro.
2. From the Experiment menu, choose Set Up Sensors and select your interface.
3. Drag the Digital Control Unit icon to the DIG/SONIC1 button.
4. Click on the DIG/SONIC1 button and select Digital Out.

**Tip:** You must have the temperature probe plugged into the interface for this option to be available.

5. In the configuration window, check the box next to Turn ON When.

**Tip:** The default configuration is to turn on DCU line 1. There may be situations when you will want to turn on a fan and an indicator light at the same time. You have the option to turn on up to three electronic components simultaneously. Note the allowable combinations of digital lines in the drop-down list.

6. Check the radio button next to Greater Than, and enter your team's threshold value.
7. Click OK and close all configuration windows.

**Tip:** When the configuration window is closed, the DCU immediately assumes control of the fan. There is no need to click the Collect button when using the DCU with the Stainless Steel Temperature Probe.